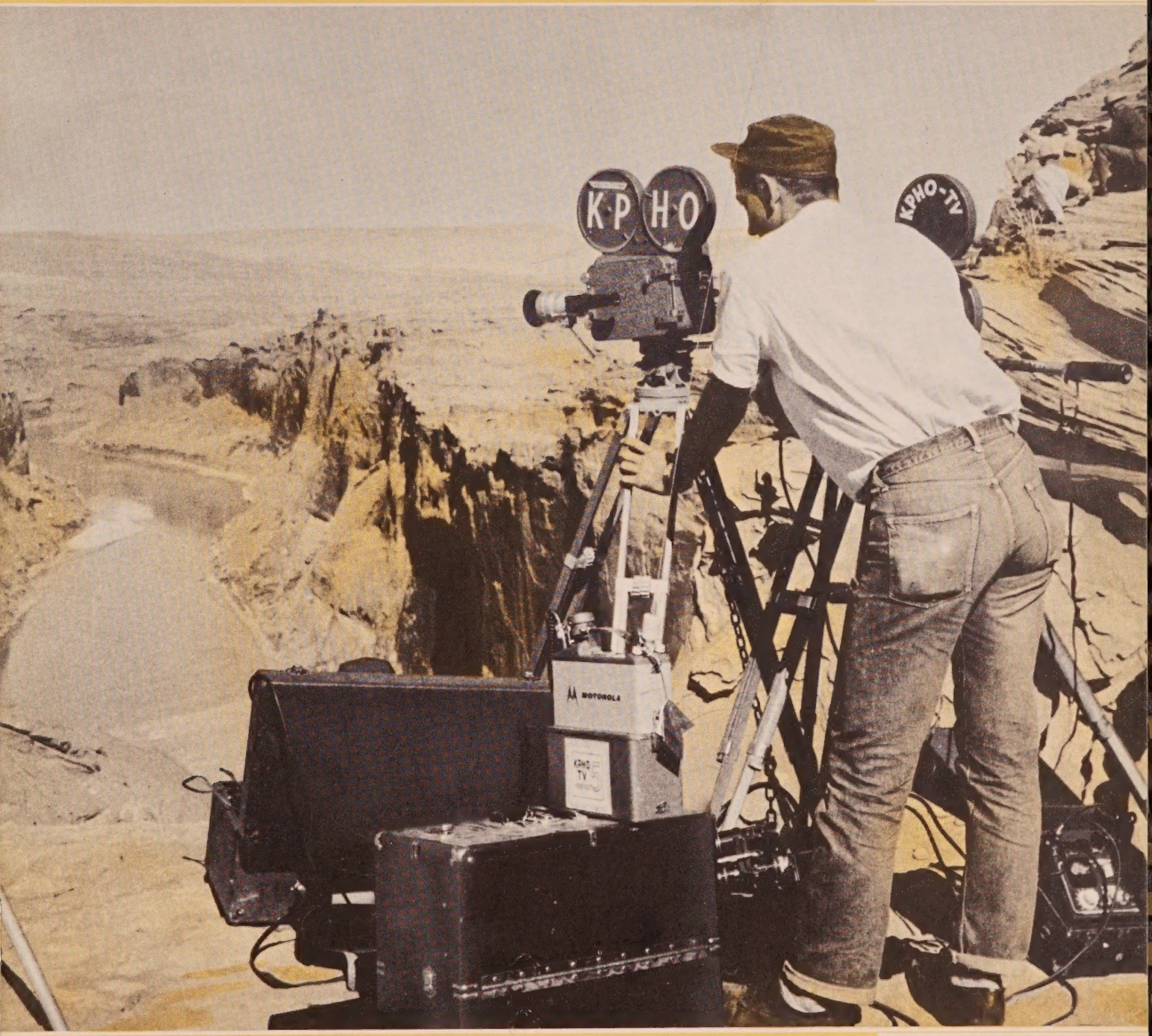
Jan.-Feb., 1957

MOTOROLA newsgram

Published by Motorola Inc., Communications and Industrial Electronics Division



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With Portable Radiophones . . . See Page 18

You Should Know About TARC

The mobile radio user has a stake in the UHF-VHF TV controversy. Most of you know that little use has been made of the UHF television channel assignments by the TV industry. The complex engineering and economic factors which have contributed to the rise of the VHF TV service and the decline of the UHF service are too complex to delineate in detail, but a few obvious influences may be listed. At the time the allocations were resolved, the VHF engineering art was substantially ahead of the UHF art. Receivers and transmitters could be manufactured to provide immediate VHF service, and the UHF service lagged. The UHF installations that were made provided a more limited area of service than that offered by VHF, because of lower power, less sensitive receivers and because of the more rapid attenuation of the UHF signal beyond the line-of-sight. With few UHF receivers in the hands of potential viewers, and with the advertisers reluctant to support programs for a limited audience, UHF stations found it difficult going in some areas and nearly impossible to exist in areas where they were forced to compete with VHF stations. From this very sketchy outline, you can understand why there has been a strong build-up of VHF systems and service, and a feeble stirring-about in the UHF part of the spectrum.

It is apparent to students of the problem that there are insufficient channels in the VHF spectrum to permit the development of an adequate competitive TV service. The existence of a small, but dominant, select group of stations under the control of two or three networks would not only pose a threat of economic monopoly, but would present the potential danger of placing the power of propaganda influence through mass communication, in the hands of a small group of men.

Adding more VHF stations will degrade the service to a point where it may not equal the potential of the UHF service. The only logical solution would seem to be the development of a full competitive UHF television service on a nationwide basis. Since UHF stations cannot tolerate VHF competition, it has been suggested that the VHF stations be eliminated and that the TV service be confined to the UHF spectrum only.

I think engineers are agreed that, with the present state of the art which can produce 25, or even 50, kilowatts of power to deliver to an antenna at frequencies as high as 900 megacycles, the possibility of providing excellent UHF TV service is very great. Unfortunately, the dollar investment inertia to the proposed change from VHF to UHF is almost overwhelming. The millions of VHF TV receivers in the hands of the public, and the hundreds of established VHF TV stations, cannot be wished out of existence or disposed of by an FCC report and order in any simple, fair and effective fashion. To succeed, such a proposed change will require unanimous TV industry support, and even then a period of ten to twelve years will be required to effect the transition.

The FCC has proposed to set up a selected group of cities with UHF TV only, and to institute a study program to evaluate the problems, the potential, and the possible pattern of growth for the UHF service. Out of this study should come either a decision to move from the VHF to the UHF band, or to set up some alternate recommended configuration for a national competitive TV service. From our mobile-radio-service point of view, we wonder whether the TV industry will attempt to keep both the VHF and the UHF channels with some sort of a split pattern. With the other radio services of the country starving for spectrum space, spectrum waste is intolerable. The TV industry cannot be permitted to waste spectrum resources in an inefficient allocation of channel assignments.

The mobile communications services can use either the VHF or UHF channels to great advantage. Quite aside from special problems facing the TV industry, the obvious fact must be faced that no privileged group in any single area of national industry can be permitted to sit on unused valuable spectrum space indefinitely. Either the UHF channels should be put to use or they should be freed for use by other services desperate for adequate spectrum space.

Let us hope that the resolution of this important problem will follow a controlled and cautious path. If a general allocation hearing should be held too soon, the radio industry as a whole would be thrown into a state of indecision and stalemate which would produce economic chaos, and stop systems growth in all services. The calling of engineering conferences and the organization of task group study programs offer a rational approach through the orderly processes of analysis and recommendation. Only when there is a substantial engineering resolution of the problems as a whole, should the allocation hearing be called. A premature allocation hearing would yield decisions by political pressure, rather than by engineering evaluation.

Through public notice 35638, dated August 31, 1956, the FCC has called upon the National Association of Radio & Television Broadcasters; the Radio-Electronics-Television Manufacturing Association; the Joint Council of Educational Television; and the Committee for Competitive Television and the Association of Maximum Service Telecasters, Inc., to establish a Television Allocation Research Committee (TARC) to study the VHF-UHF engineering problems. This is a constructive step, but watch developments carefully.

The mobile services must stay alert. You cannot escape the fact that the TV UHF-VHF controversy is tied to your problem of finding space in which to grow, but let's hope we don't have to spend the next several years in Washington attending hearings. Keep your eyes on TARC.

Dan Noble

The
MOTOROLA
NEWSGRAM

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Communications and
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Technical Information Center

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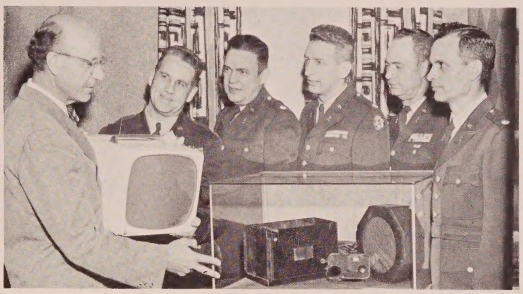
Please address all inquiries concerning sales, service or distribution to:

MOTOROLA COMMUNICATIONS and ELECTRONICS, INC.
4501 W. Augusta Blvd.
Chicago 51, Illinois

Motorola Again Participates In Ordnance Officer Training



D. E. Noble (left), Exec. V. P. of Motorola, shows oldest and newest Motorola products —the first car radio and the new portable TV set— to Lt. Colonels R. E. Harper, R. C. Barber, F. Kornet, T. B. Jones, and N. C. Pardue.

For the second consecutive year, Motorola has been chosen by the Army Ordnance Corps to participate in an Executive Development Program for five senior officers who are preparing for top management assignments.

As part of a 21-month training program, the officers, all lieutenant colonels, are now studying management policies and techniques employed by Motorola. The program also includes study at the University of Chicago, as well as three-month assignments at four other Chicago area corporations and two three-month tours of duty at the Chicago Ordnance District.

These officers will eventually be given management assignments at arsenals, ordnance districts, depots and proving grounds, where their duties and responsibilities will closely resemble those of an industrial executive, especially in scope of fiscal responsibility and executive functions. » » »

Motorola Awarded $ Million Transistor Development Contract

A one million-dollar transistor development contract has been awarded to Motorola Inc. by the Signal Corps Supply Agency, according to Daniel E. Noble, vice president in charge of the Company's Communications and Industrial Electronics, Military and Semi-Conductor Products Divisions.

Work on the new contract will be performed by Motorola's Semi-Conductor Products Division in Phoenix, Arizona, where Motorola already has a number of transistors in various stages of development and is currently mass-producing an audio power transistor. » » »

SEMI-CONDUCTOR PRODUCTS DIVISION NAMES EASTERN SALES MANAGER

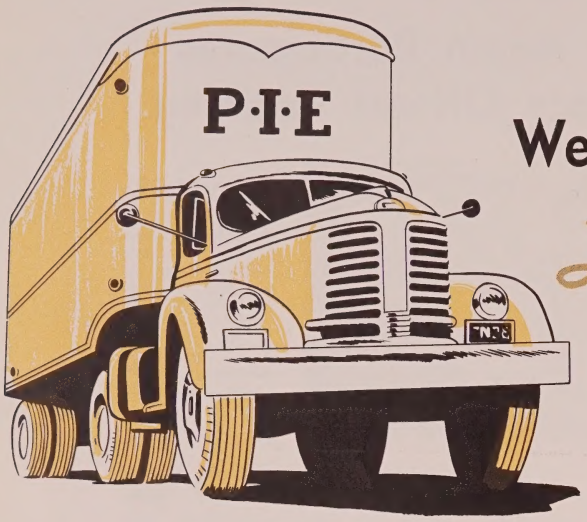
Jon B. Jolly has been named eastern Regional Sales Manager for Motorola's Semi-Conductor Products Division, it was announced by John T. Hickey, General Manager of the division.

In his new position, Jolly is responsible for the marketing activities of the company's line of transistors and other semi-conductor products throughout the eastern section of the country. He will headquarter at Motorola's regional office in Northern New Jersey.

Jolly graduated from the Georgia Institute of Technology and is a member of the. Institute of Radio Engineers. He has had previous experience in the semi-conductor field with CBS-Hytron and General Electric Company.

STOLEN

A Motorola mobile unit Model FMTRU-5V, serial no. 19339, has been reported stolen. Any information on the whereabouts of this unit should be sent to Ray Cramer, Southside Communications, 2657 W. 87th St., Evergreen Park 42, Ill.



Western Trucker *Looks to the Future* with "PRIVATE LINE" 2-Way Radio

Pacific Intermountain Express is now utilizing the latest major advance in two-way radio for city pickup dispatching from their Oakland, Calif. terminal. They are one of the first companies to use Motorola's new PRIVATE LINE radio, which shuts out almost all interference from other stations on the same channel. Results have been so outstanding that they have already gone ahead with a second installation of PRIVATE LINE radio at their new Los Angeles terminal, and are planning to follow this up with similar installation at Salt Lake City, Denver and other major P.I.E. terminals eastward along their line-haul routes, including Chicago.

One of the reasons P.I.E. delayed installing two-way radio dispatching was the noticeable "co-channel" interference that sometimes exists when a number of truck companies in the same area operate radios on the same channel. The heavy stream of extraneous radio "traffic" from other truckers may become exceedingly irritating—actually fatiguing—to drivers. Motorola's new PRIVATE LINE radio avoids this, however, because the receiver "opens up" for listening only when a message is being received from a P.I.E. station. At all other times the loudspeaker is inoperative.

When P.I.E. installed their radio system, they were the only users of the 44.02 mc radio channel in the San Francisco-Oakland Bay area. However, mobile communications is one of the brightest service tools to come into the trucking industry in more than a decade. By installing a PRIVATE LINE radiophone system, P.I.E. was assured of protected communications later when their channel has more occupants.

Even now the new system is providing protection from interference from distant stations—the erratic "skip" type of reception brought about by excessive sun-spot activity, which is getting more bothersome as each month passes. But P.I.E. drivers and dispatchers never hear such interference and therefore have no difficulty deriving full benefit from mobile radio dispatching.

Here are some examples of instances when such benefits occur:

When a driver finds himself last in line at the receiving dock, he can radio the dispatcher and get instructions—possibly to drive on to his next stop, thereby saving many minutes and sometimes hours of waiting.

When a question arises about some shipment, or there is some other difficulty, the driver can get immediate and expert guidance from the dispatcher merely by using his radio. Or he can radio for on-the-spot help from one of the two local driver supervisors, Richard Amauric or George King, who patrol the city in radio-

Mobile radio saves between four and ten hours of productive truck time per week by expediting reports of road breakdowns.

Chief City Pickup Dispatcher Tom Armstrong gets pickup order slips from phone operators and radios new assignments to the nearest free truck.

equipped cars to give just this sort of help.

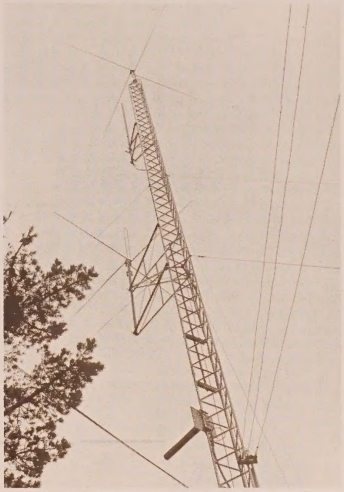
When a "wild" pickup call (other than a regular pickup) comes in, chances are excellent that the dispatcher can have one of the 58 radio-equipped trucks make the stop within a few minutes. Savings in mileage is considerable in view of the 400 regular stops and 300 "wild" pickups made on an average day.

Even line-haul operations benefit from the use of two-way radio by city pickup trucks. One of the reasons for this is greatly improved efficiency of the "shuttle" service P.I.E. operates between the main terminal at Oakland and a smaller terminal in downtown San Francisco. The information the dispatcher gets by radio as the day progresses enables him to vary the number of empty trailers sent over from Oakland to San Francisco to accommodate the freight volume at the moment. The faster, smoother cartage operation now means that in many instances considerable time can be sliced off transcontinental shipments.

Mobile radio offers many opportunities to provide shippers with unusual services, such as in this recent typical case:

A truck left one morning to make deliveries in the northern industrial area along the bay. Among other things it carried a 2,000-lb. heavy-duty tire for an earth-moving machine which, normally, would not have been delivered on the other side of the bay until late A.M. After the truck was well into its morning deliveries the consignee called to say that the tire was urgently needed . . . a crew was waiting to mount it on the machine. In seconds the dispatcher was in contact with the driver by radio, and the truck was re-routed to make an emergency delivery *hours sooner* than formerly would have been possible.

P.I.E. spares no effort to give maximum service to its shippers. Speed, reliability and the kept-promise have built their business. Now, Motorola PRIVATE LINE radio is not only making it much easier to keep up this kind of performance, but is also providing assurance of effective communications for years to come. » » »



P.I.E.'s antenna tower is on top of Grizzly Peak overlooking Oakland.

For clarification on his shipment, driver J. McLennan radios the dispatcher.

As day breaks, P.I.E.'s fleet of 58 radio-equipped trucks at Oakland is readied for city pickup service.

John Warfield looks on while Barton Woolfolk resolves a problem over radio.

TUNNEL FIRMS USING MOTOROLA 2-WAY RADIO

Time is money when six construction firms are working together on a project such as the Patapsco River tunnel in Baltimore, Md.

When a man or machine is wanted, the need is immediate. Now, with Motorola two-way radio on the job, when Barton G. Woolfolk, superintendent of construction on the C. J. Langenfelder & Son approach sections for the tunnel wants a man or machine, he pushes a button on a microphone and speaks into it.

Immediately his voice is reproduced in crisp tones at two base stations across the harbor, at the equipment repair shop, at the concrete batch plant near by, and in 47 Langenfelder vehicles strung along the 11 miles of highway his firm is building.

Mr. Woolfolk explained his liking for the two-way radio system.

"Suppose you've got a power shovel worth $25 a day and ten to fifteen smaller pieces, each worth its own amount, working under the shovel. When that shovel breaks down, you might spend half an hour or more finding one of your mechanics and getting him on the spot.

"Then after the mechanic finds out what's wrong, he takes another hour or so ordering parts and getting a truck to carry them to the breakdown. It ends with losing plenty of money.

"With radio, the mechanic can be on the scene in minutes, order parts from the shop and have them there in more minutes. Result: You've saved a lot of cash."

The same principle applies in tight co-ordination between the concrete batch plant, where all concrete is premixed before being sent out on jobs.

Mr. Woolfolk said that savings in nonwaste of mixed concrete, drivers' and workers' time, the time of his mechanics and superintendents, vehicle wear and in other items average nearly $100 a day for his company alone.

"That doesn't even count the savings in nerves and strain," he added.

This saving of time, trouble and money is duplicated dozens of times a day in that firm, and in five others that are heavily engaged in work on the tunnel and its approaches.

Others beside Langenfelder that have Motorola two-way radio networks are Merritt-Chapman and Scott, Eastern Contractors, the Nello Teer Construction Company, the C. W. Wright Construction Company, and the Wright Contracting Company.

NEED DEMONSTRATED

It demonstrates that enormous modern construction projects, like modern armies, could almost disintegrate without two-way radio communication.

The radio networks used by the six tunnel firms employ ten base stations and mobile units mounted on 121 vehicles of all types—station wagons, dredges, low-boys, pick-up trucks, barges and work boats.

With each unit estimated make over ten calls a day, the air around the tunnel and highway constructions probably carries nearly 2,000 messages each 24 hours, on the average, concerned directly with the tunnel work.

The savings these firms make by using the radio system runs into hundreds of dollars a day, or hundreds of thousands for the total project when it is completed late this year.

For Merritt-Chapman and Scott, with work crews on both sides of the harbor and on barges and rigs strung out across the harbor, this close co-ordination can sometimes pay off even more.

Co-ordination between units the company's costly fleet of floating equipment could be a real problem without the radio link. Supervisory personnel can be located and put at the spot where needed with no delay.

For the Eastern Contractors, breakdowns in their hauling vehicles can be put under repair fast, and trucks moving materials can be rerouted to where they are needed most even in midroute, if necessary.

Some of the construction men say that refraining from their choicest language, while on the air, is the hardest part of using the two-way radio.

Federal Communications Commission monitors run frequent checks on the channels used for these systems, just as they do for regular broadcasting station networks.

"That can even come in real handy, though," one of the men said. "When you get the feeling you're about to get a real blessing out, all you have to do is give a gentle reminder about cussin' on the air."

BITS OF CONVERSATION

Brief snatches of a conversation can give a listener a good idea of how money savings are effected by using radio. One went:

"It's going to take me another two hours with the men I got to get this fill in shape."

"Well, go ahead, it's got to be done."

"Overtime starts at half past three . . . Did you hear me?"

Sam Benedella, project manager for Eastern Contractors, receives radio message from his office diverting the truck in background to another tunnel highway location.

Charles B. Asensio on the workboat, Captain Lew, gets a radio call.

"Yeah. We won't work overtime. Knock the men off at 3:30."

Mr. Woolfolk, or any of the other company's superintendents can be reached by telephone in the field by means of the two-way radio and a person to transmit the message from phone to radio.

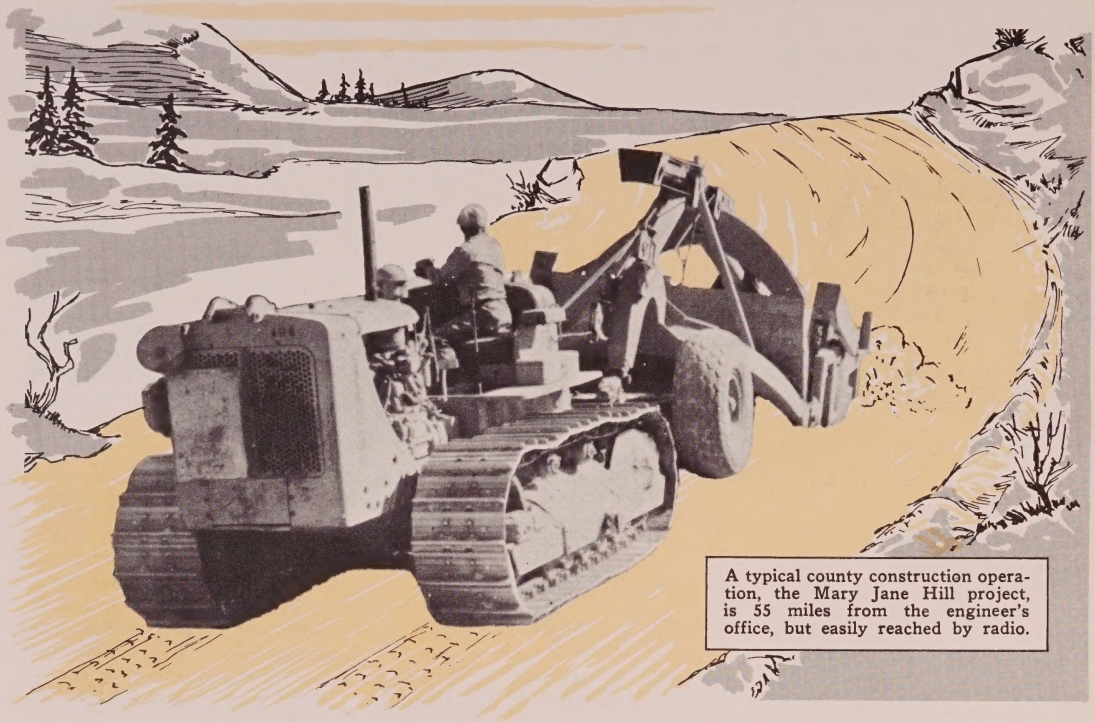
RADIO IN CAR

Also, in the 25 minutes that it takes Mr. Woolfolk to drive to work in the mornings, he cuts on the radio in his car which is tuned to the company frequency and by the time he arrives, has heard his men making their arrangements for the day and is thus briefed on the situation.

The two-way radio can even provide diversion from a tough day's work. Other construction crews in other parts of the nation sometimes come into the local sets through freak atmospheric conditions that cause the radio waves to skip.

"A bunch down in Texas is the best, "Mr. Woolfolk said. "One day this fellow named PeeWee comes on. He's got a real Texas drawl and starts complaining that he's lost a pair of tongs."

"Well, I cut in on him and with this voice of mine, he must have believed I was from Texas, too, 'cause he sounded mighty upset until I told him where I was transmitting from. Then he laughed too." » » »



A typical county construction operation, the Mary Jane Hill project, is 55 miles from the engineer's office, but easily reached by radio.

DOUGLAS COUNTY CREDITS RADIO WITH SAVING LIVES

February tenth dawned clear and cold, with just a faint suggestion of a breeze stirring. Douglas County, Washington, was just recovering from a heavy snowfall, one of the worst winter blows to hit that region since 1939. Already there had been a grand total of 113 inches of snow.

Douglas County lies in an unprotected position typographically, being directly adjacent to the Cascade Range. It ranges in elevation from the 600 foot Columbia River level to the 5400 foot slopes of Badger Mountain, with no forests to stop the sweep of the wind.

When Pat Thomson, County Engineer, called his three area supervisors by radio, the consensus was that in two days all routes should be clear. But only three hours later puffy gusts of wind streamed small banners of snow from the gentle rises and lazily spread ribbons of it across the roads. To the initiated, these were the signs.

Thomson radioed all supervisors for an open conference. As the supervisors and Thomson discussed possible emergency operations, the storm descended in deadly earnest. Five days later, winds over thirty-five miles an hour still blasted snow, sledgehammering it into the road cuts. Over three hundred miles of rural roads were blocked, four towns were cut off from all vehicular transportation, schools were closed, and full scale emergency conditions existed. Drifts of hard packed snow were five to eight feet deep, and almost impossible to crack open.

Listening to the radio, Thomson could follow the progress of the 25 snowfighting units in operation. Long range radio coverage was good, reaching even into the abrupt, deep, coulees with open-conference call clarity. The system, consisting of an automatic radio relay station, four fixed stations and thirty-eight mobiles, was providing the operational efficiency that had been designed into it by Motorola communications engineers and Douglas County personnel.

With radio, there was fingertip control of twenty-five snowfighting units over the county-wide area comprising of 1768 square miles with 1670 miles of rural road.

One plow reported three stranded vehicles with only about four inches of the tops visible above the drift. Occupants were shoveled out and brought to safety. Four machines working on school bus routes near the

county seat battered for nine hours making an aggregate total of less than three miles.

Another plow was dispatched to clear the way into one hundred head of cattle needing attention. Another man reported his machine with a broken axle from repeated slammings into the heavy drifts.

The lives of humans and stock literally depended upon the invisible radio waves putting the fifteen-ton monsters into snowfighting action. In five windblown days, one can really learn the activities of a rural community. Old folk die, babies are born, legs are broken, a child is burned against a stove, salesmen get trapped in snowdrifts, towns need supplies, schools need heating fuels, and stock needs feed. And a dispatcher in an office, by tripping a switch, sends snowplows hurtling in all directions to clear the roads.

But snowfighting is only one of the major county activities in which radio has an important function. Radio also facilitates regular maintenance, construction, and cooperation with the sheriff's office, and the fire districts.

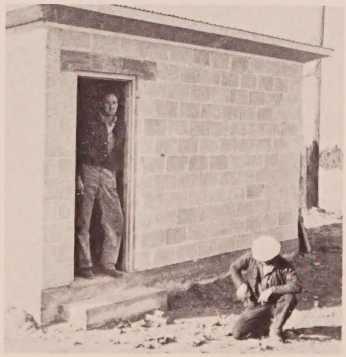
The county economy is generally agricultural with four to five million bushels of wheat produced annually. A ground fire on the plains rippled by a light wind is disastrous if not checked almost immediately. Since county employees cover the entire area almost daily in regular maintenance work, they can report any and all fires seen. Thus, the advantages of having the fire districts on radio network hookup are readily apparent. In many other instances, the fire district also needed road equipment to help fight a fire.

Mobile radio in a pickup truck keeps this crew, which handles major road patching, in contact with the engineer and area supervisor.

The same principle holds true of working in conjunction with the sheriff's office. Road department personnel have been able to assist in application of road blocks, giving a direct assist to law enforcement. And conditions arise where communications allows county personnel to report road restriction violations directly to the nearest patrol car for immediate action, thereby preventing great damage to the bituminous surfaced roads from heavy overloads.

It is difficult to evaluate the use of radio in dollars and cents. In the past two years, it has saved Thomson some 10,000 miles of travel, for his annual county average was near 30,000 miles. But how do you evaluate the life of a new born babe, or a dying parent? The life of one individual eclipses the cost of any system. In material matters, there is time saved in moving equipment, in making repairs and finding replacement parts for stalled equipment. There are financial savings from being able to make instant decisions on construction job problems, emergency situations, and the local snarls of daily operation. The public relations of a more satisfied rural populace is an immeasurable item. And the internal knowledge that everything possible in the realm of science is being used to alleviate the public's problems is a great satisfaction. » » »

This Galion 118 motor patrol, after pulling into the shop yard to refuel, was rerouted via radio by the Supervisor who was 14 miles from the shop.



The base station (elevation 5400') provides excellent coverage of the county.

450 Mc Radio Relieves Co-Channel Congestion In Metropolitan Areas

A strong proponent of radio dispatching for Black & White Cabs in St. Louis is Oscar Heintzman, left, shown discussing the Motorola system with Supervisor-Driver Floyd Ruhland.

SHADES OF GOOD OLD DAYS

ADVANTAGES of radio dispatching to metropolitan taxicab operation are firmly established. The question now is: Can 2-way radio do its full job under today's extreme congestion wherein every available metropolitan 150 mc taxi channel is overloaded and more radio cabs are hitting the streets?

Black & White Cab Company answers with a rousing "YES," and to prove its point, this St. Louis company submits its experience of 100 per cent interference-free operation in the midst of more than 2,500 radio-equipped taxicabs.

There is no secret to it. Black & White's three base stations and 250 mobiles enjoy plenty of elbow room in the uncrowded 450 mc taxicab band, far above the bedlam of 150 mc VHF cab channels.

Black & White's choice of UHF radio was born of necessity (competition forced them into radio) and tardiness (they passed up radio until 1953, when all four 150 mc channels were filled) plus a desire for something better than their competitors had. The decision to get a radio system was reached in 1952. But at that time all 150 mc channels were heavily populated in St. Louis, with an average of 300 cabs on each channel. Some idea of the congestion in the Greater St. Louis area can be gained from these totals: About 1,900 taxi permits on file in the city proper, and an estimated 1,000 more cabs in the county towns and across the Mississippi River in neighboring Illinois cities. Of the total, a good 90 per cent are radio-dispatched.

Black & White officers, after listening a few hours on the crowded 150 mc channels, decided the "something better" they wanted was to be found only in the 450 mc band. After several months' wait, the B&W radio network went on the air in July, 1953.

Based on three years' operating experience, the Black & White management is firmly convinced of the wisdom of their choice of UHF frequencies. "We simply can't see why any operator will put up with part-time radio service on a congested 150 mc channel when there's so much clear air in the 450 mc band," declares John J. Smith, B&W vice president.

Ex-banker Smith weighs 150-vs-450 taxi radio on a profit and loss scale.

"True, our UHF equipment costs a little more to purchase. Against that factor, look at what we gain:

"1. 100 per cent use of our equipment, without waiting for co-channel licensees to get their share of air-time.

"2. Every message on our channel gets through the first time and commands drivers' attention, because nobody else uses our channel.

"3. Our system makes the drivers' job easier, because they don't have to monitor a constant stream of calls that may not affect them.

"4. It's more pleasant on passengers to ride in a cab without constant radio babble.

"5. Our dispatcher's task is far easier on a clear channel, where the only incoming calls he receives are from our own cabs."

The 450 mc Taxicab Radio Service contains five pairs of frequencies grouped for either duplex or simplex operation. Frequencies assignable to base stations or simplex systems are spaced 100 kilocycles apart between 452.05 and 452.45 mc. Frequencies assignable exclusively to mobiles for talkback are 5 mc higher—457.05 to 457.45 mc.

As might be expected, the loudest rooters for the 450 system are the men closest to it—drivers and dispatchers.

Drivers who have had previous experience with conventional 150 mc VHF radios notice the improvement immediately when they change over to Motorola 450 mc sets. "So much quieter . . . only one dispatcher talking, instead of maybe half a dozen cutting each other off in the middle of a message," remarks a veteran driver.

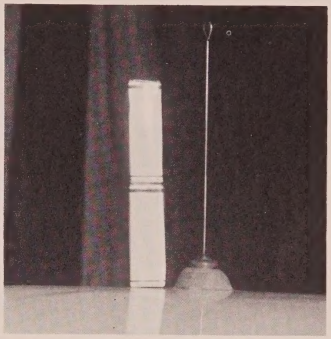
The dispatchers report similar improvement. Chief Dispatcher Joseph Cody seldom has to give a message twice or ask for a repeat from a cab.

For maximum flexibility, Black & White specified a Motorola three-station system, comprised of a downtown base atop the 130 foot Melbourne Hotel; a second base six miles southwest, with the antenna mounted on a 225 foot high water tower; and a third base situated 12 miles northwest on a 90 foot water tank. Each fixed station is remotely controlled by wire line from the cab center downtown.

Under a Motorola Maintenance Agreement, Mobilfone Corporation, Motorola's St. Louis authorized service station, installed and maintains the radio equipment. A unique control method was devised by which the dispatcher can broadcast his orders over any of the three base transmitters, depending on the location of the pick-up.

During rush periods dispatching duties can be split up into a two or three-man operation, with separate microphones for the operator controlling each base sector. To minimize the distracting sounds of several receiver loudspeakers talking at once, the incoming radio messages are heard through lightweight headsets worn by the dispatchers. This is a great help to the telephone operators who work in the dispatch room.

Coverage patterns of the three remote base transmitters overlap somewhat, with the downtown main station giving almost full city coverage. A planned re-location of the downtown station atop the Continental Building—highest radio antenna elevation in St. Louis—is expected to give even better coverage and may make the other stations unnecessary.



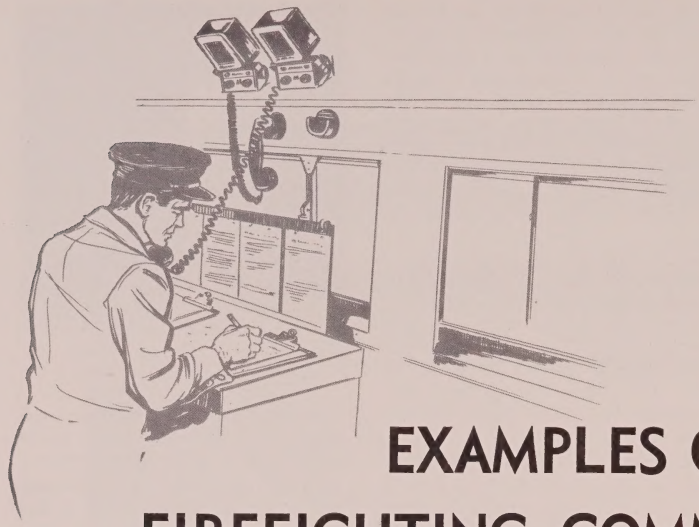
You can recognize 450 mc radio by its 6" antenna.

Under the Motorola Maintenance Agreement, Black & White drivers can receive drive-in service to their cab radio sets any time during a 16-hour daily period. The Mobilfone radio shop is located downtown within a short distance from the cab center.

From a fiscal standpoint, one of the most pleasing results of Black & White's radio operation has been in the sizeable savings achieved. After putting in Motorola 450 mc radio, the number of cab stands was reduced from 96 to about 60, with a resultant 50 per cent slash in this monthly expense. In addition, reduction of dead mileage has yielded at least a 10 per cent saving in total cab mileage. » » »

Control box enables Chief Dispatcher Jo Coty, center, to select the best of three base stations for each call.

After comparing 150 and 450 mc radio, Vice President John J. Smith came out for the interference-free 450 mc band.



EXAMPLES OF EFFECTIVE FIREFIGHTING COMMUNICATIONS

FOR COORDINATION

The New York City Fire Department has a mobile field communication truck to coordinate firefighting efforts at major fires. The unit, containing seven Motorola two-way radios, is on a 24-hour alert to speed to major fires.

Deputy Chief Thomas P. O'Brien, head of the bureau of fire communications, is in charge of the unit, which is manned by a lieutenant and two firemen. Until this mobile field communications unit was set up, all communications at a fire were by word of mouth. Now Motorola HANDIE-TALKIE portable radiophones have been given to all chief officers so that the field unit can get instantaneous reports from all of them working on a major fire. As a result, the officer in charge will always have a complete picture of the fire and can redeploy his forces as the need arises.

The mobile unit also maintains contact with all units of the Fire Department. Because it is in touch with the department's central office, the communications truck can leave quickly if a larger fire develops in another area. The radio truck also furnishes additional portable radiophones if more are needed at a fire.

Early use of the field radio truck was so successful that eventually there will be one for each of the five boroughs. » » »

Firemen August Giroux and Dan Bergin demonstrate the New York Fire Department's mobile field communication unit which is used at major fires.

Fire Chief J. Edward Hutchinson is shown during fire at Greensburg, Pa., as he radioed for Greensburg's city hall to summon more district fire departments for assistance.

FOR CALLING UP REINFORCEMENTS

First sign of the fire was smoke coming from the storage shed at the rear of a lumber mill. The fire, fed by the dry wood spread quickly, and by the time firemen arrived had enveloped the entire shed. A 55-gallon drum of fuel in the shed exploded, with flames jumping across to the mill and sparks showering the entire area.

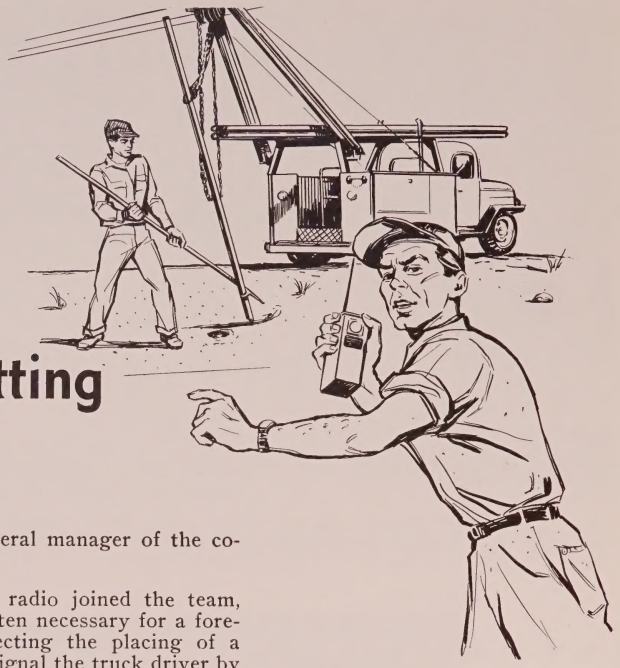
Fire Chief J. Edward Hutchinson of Southwest Greensburg's (Pa.) Fire Department saw that the main lumber mill and several other plants were threatened. By means of a Motorola HANDIE-TALKIE portable radiophone he called for Greensburg's city hall to summon more district fire departments for assistance.

The result was a mammoth cooperative effort by about 250 firemen of 11 different district hose companies. Although the blaze was intense enough to break windows in buildings as far as 150 feet away, scorch the roofs of several neighboring structures, and even melt out of shape the rails on a nearby railroad siding, firemen were able to save the lumber mill from complete destruction and confined the actual blaze to the immediate lumber company area. They also extinguished a fire that started in a truck of the neighboring welding company.

Fire companies fighting the stubborn blaze included: Southwest Greensburg, the six Greensburg companies, South Greensburg, Midway-St. Clair, Carbon, and Hempfield No. 2. » » »

With his HANDIE-TALKIE radiophone, Chief Hutchinson directed placement of fire apparatus of other district fire companies.
(Photos by Castle J. Pyle)

Radio Cuts Hazards In Hot Line Pole Setting



Construction and maintenance crews working with electricity are well aware of the hazards of a "hot" line.

At Lorain Medina Rural Electric Co-op, Inc., Wellington, Ohio, foremen now are equipped with Motorola *HANDIE MICRO-TALKIE* transmitters. Talking into these lightweight units, each foreman can be heard through the mobile two-way radio receiver unit mounted in the construction trucks. This gives him immediate contact and control for more safe, efficient pole setting and other operations.

"Electric line operation and reconstruction imposes many types of hazards," says Karl B. Crawford, general manager of the co-op.

Foreman Vickers using his HANDIE MICRO-TALKIE transmitter to contact driver.

Before radio joined the team, it was often necessary for a foreman directing the placing of a pole, to signal the truck driver by hand signals, whistles, a bell cord or a buzzer at the back of the truck. In response to such signals the driver would back up, move forward or shift his boom position. He was completely dependent on instructions from the foreman as he could not see the work as it progressed.

When setting a pole in a "hot" line, this "blind" operation made it possible to hit the hot line and send the charge back into the truck body.

With the old buzzer arrangement, the foreman was confined to a location right at the truck. His position placed him in danger of both shock and being hit should a pole fall or shift suddenly while being positioned.

Another problem occurred when several trucks were on a job. The foreman had to stand where the drivers could see him and his signals. This meant several men often had to be positioned just to relay signals. Time was lost, as well as wrong moves made when signals were misunderstood or missed completely.

Now, with the *HANDIE MICRO-TALKIE* transmitter, one foreman can safely and surely direct the efforts of one or more pole setting unit or wire crew.

It has proved much more practical to have the foreman able to be where he is needed most, and still be able to communicate instantly with truck drivers and winch operators. Under traffic conditions, the "talker" can direct work safely from a traffic point.

Foremen like the two-pound unit because of the freedom of action and the direct control it gives them. When it isn't needed, they carry it out of the way in their pocket, or by the loop antenna which doubles as a handle.

Lorain Medina's safety record reflects the confidence of the work crews in the new system. Wire stringing jobs are faster and safer when instructions result in immediate action even though the foreman may be a half mile away from the truck.

"We believe," states Mr. Crawford, "that safety comes first and with it will come the efficiency necessary to good electric utility operation today." » » »

Sheriff Billy Bob Crice answers radio call from officers of surrounding area through newly installed equipment in his automobile. Two-way radio operates on local police band, and a receiver is tuned to State police band.

Rapid Disposition of Cases Aided by Radio

Only four days after the town of Wickliffe, Kentucky put 2-way radio to work, Sheriff E. W. Crice and his deputy, B. Allie Hall, apprehended two juveniles in Barlow driving an automobile they had stolen in Paducah a few minutes before. But lengthy interrogation failed to break the youths' pat story. Then radio was used to contact officers as far away as Owensboro, about 120 miles. Word soon came back suggesting that these youths might be the same ones that had stolen a car shortly before and headed toward Paducah. The youths, when confronted with the additional facts, admitted that they had lied and gave a complete story of both thefts.

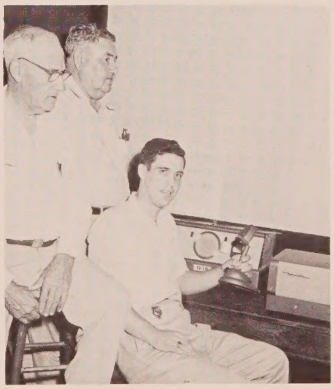
In this situation, radio helped to provide for the rapid disposition of the case. Since then, Sheriff Crice has found many other uses for his radio system—as an aid in setting up roadblocks, getting information on licenses quickly, getting emergency messages to and from residents, and maintaining closer contact with his office so that routine business can be handled without unnecessary delay.

Sheriff Crice has been sold on the advantages of radio for years. When requesting funds for his radio system, he pointed out that Wickliffe, because of its geographical location, could well serve as the police radio hub of three states—Kentucky, Illinois and Missouri. Lawbreakers trying to flee any of these states often use the highways in the three-state-junction area. Radio control would make it easy to tighten a dragnet about them.

Sheriff Crice is well on the way to solving the problem of speeding on Highway 60. With radio covering the 30-mile stretch from Paducah to Wickliffe and with contact with state troopers in the area, he expects to make this stretch the safest in the country.

Radio coverage with the Motorola FM radio system puts the sheriff in direct contact with Cairo, Paducah, Metropolis, Mayfield and Benton (up to 45 miles away). For even greater coverage, he can have his messages relayed at these points. » » »

Judge L. E. Carter and Deputy Hall watch Sheriff Crice.



2-WAY RADIO SERVES DRAV(ON LAND

"That sand is almost loaded now," Brad Grandovic reports as Tom Wilson guides sand bucket into place on trailer.

Truck Driver Richard Dower using Motorola two-way radio to call in for his next assignment after delivery.

"KCG 925 calling truck number ten," is a typical call to action over Dravo's two-way radio system.

"This is number ten, Jerry," comes the answer.

"Dick, they've got a load of steel in the Structural Shop to go to the Boat Yard," dispatcher Jerry Weisman says, and that load is as good as on its way thanks to Motorola two-way radio.

On the job over two years at the Dravo Corp., Neville Island, Pittsburgh, Pa., two-way radio communication saves many thousands of miles of unnecessary travel a year. This adds up to a big savings in time and money,

Steve "Slim" Koren, pilot of the workboat "PMO", radios for instructions prior to moving barges to Marine Ways. Motorola two-way radio provides instant communication between boat and shore for faster materials handling.

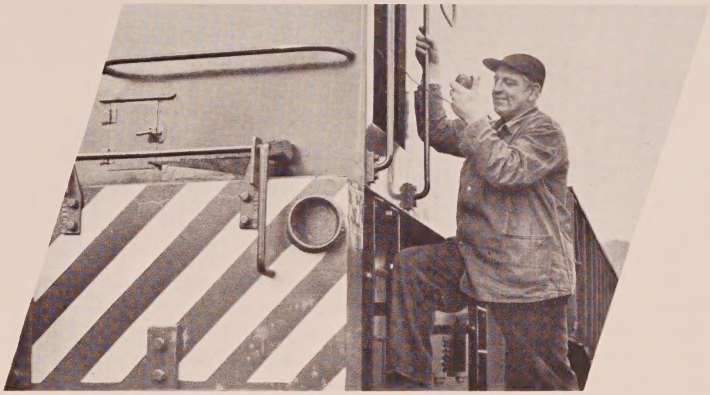
VO AND SEA

as well as helping to "get-the-job-done" faster.

The drivers especially like it because they don't need to check in at the office between each trip —they receive their orders right in their vehicles.

The scope of two-way operation at Dravo can be seen in the variety of units in operation. The FCC-licensed system includes a base station in Building N-10, a sub-station in the Marine Ways tower and mobile sets in four trucks, two "jeeps", the railroad "dinky" and the workboat "PMO". Motorola HANDIE-TALKIE portable radiophones are used at the Marine Ways and in the fire truck. » » »

Paul Simon, ass't superintendent, Marine Ways, uses Motorola HANDIE-TALKIE radiophone to contact the control tower.



Conductor George Chess telling the dispatcher "dinky" is ready to transport Dravo Heaters to their destinations.

Jerry Weisman, dispatcher for Dravo's two-way radio system, has his base station in Building N-10. He holds an FCC license to operate the equipment, and takes great pride in helping meet production schedules with fast deliveries.

Cameraman Terry Dennison films the site of Glen Canyon Dam. A Motorola HANDIE-TALKIE portable radiophone provides instant contact with a second camera crew.

2-WAY RADIO AIDS TV NEWS COVERAGE

When radio lends a helping hand to television, it's news. At the recent dedication ceremonies of the Glen Canyon Dam Construction Project, Motorola 2-way radio played an important part in coordinating the efforts of two newsreel camera crews as they recorded the proceedings for telecasting from Station KPHO-TV, Phoenix, Arizona.

Tons of dynamite lay in the cliffs overhanging the Colorado River at the dam site near Lees Ferry in northern Arizona.

President Eisenhower stood ready in Washington, D. C. to push the button that would set off the dynamite charge.

The ensuing blast, signifying the start of construction on this project, was the dramatic highlight of the ceremonies held at the site.

To capture this moment, as well as other important happenings in the ceremony, correct timing and the prompt interchange of information between the camera crewmen was essential.

Stationed high in a mountain overlooking the proposed dam site, Terry Dennison, Director of Photography for Station KPHO-TV, kept in constant contact with his second crew by means of portable *HANDIE-TALKIE* radiophones. The second crew was located on the opposite side of the river covering other scenes.

Before the dramatic ending of the dedication ceremonies, noted speakers outlined future plans for development of the dam.

Motorola portable 2-way radio provided the instantaneous voice contact . . . the split-second timing required to photograph important program segments as they developed.

Glen Canyon dam will be located about 22 miles above Lees Ferry in northern Arizona.

Of concrete arch gravity design, the dam will be over 1,400 feet long, and rise 700 feet above bedrock—580 feet above the river bed.

This tremendous mass of concrete will house seven generators with a combined output of 800,000 kw.

The dam will be constructed under the direction of the U. S. Bureau of Reclamation, and will cost approximately $421,000,000. It is expected to repay its cost from power revenue.

At the completion of the project, the Colorado River will be contained at this point to form a reservoir which will cover over 26 million acres of land. » » »

Orin B. Bond, (Right), owner of the Belmont and St. Matthew's Cab Companies, and John P. Tansey, Motorola's National Service Manager, view the Motorola desk-top base station which was operating normally despite the external and internal scorching and water damage received during the fire.

BASE STATION WITHSTANDS TRIAL BY FIRE

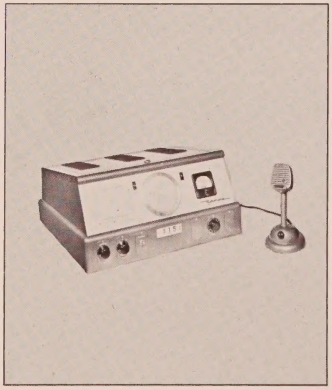
At 4:42 A. M. on Sunday, November 25, two engine companies of the St. Matthews (Kentucky) Volunteer Fire Department responded to a fire alarm at 310 Wallace Ave.

The general offices and dispatching center for the Belmont Cab Company and the St. Matthews Cab Company were afire, with flames shooting through the roof to a height of 60 feet or more. The central fire alarm's wails combined with the sirens of fire-fighting equipment speeding to the scene to attract a large crowd to the dawn emergency.

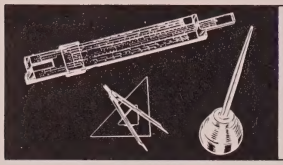
The efficient and speedy efforts of the St. Matthews Fire Dept., under the direction of Chief John W. Monohan, soon brought the flames under control. Even before the fire was out, Orin B. Bond, owner of the cab companies, assisted by a fireman, had cut the antenna coaxial and power lines from his desk-top Motorola base station used for radio dispatching and control of his cab fleets, and had relocated the unit in an emergency control center in an adjoining building.

Despite the intense heat to which the base station was subjected (the control knobs had melted into tear-drop configurations) the unit was restored to service by replacing one tube, splicing a section into the antenna coaxial line and reloading the antenna. The frequency and modulation of the transmitter were not affected and the sensitivity of the receiver remained at .5 microvolt.

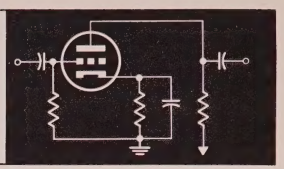
The radio systems are maintained by an Authorized Motorola Service Station, Louisville 2-way Radio Service, Inc., whose personnel reported shortly after the alarm and had the radio dispatching equipment in operation hours before land lines were restored to service. » » »



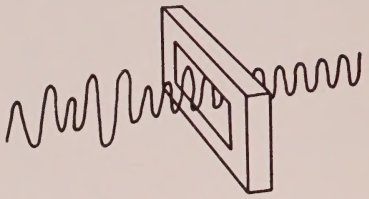
This is how the desk-top base station looked before the fire.



Technical Notes Section



The Motorola Noise Compensated "Anti-Clamp" Squelch Circuit



To provide effective squelch action under varying signal conditions, Motorola has further improved its exclusive noise-compensated squelch by incorporating an "anti-clamp" circuit.

From first glance, the squelch circuit of an FM communications receiver might appear quite complicated. Actually, it is no more complicated than any other part of the receiver circuitry such as the oscillator, mixer, or IF stage. Basically it consists of three stages; (1) the noise amplifier, (2) the noise rectifier, and (3) the DC amplifier or squelch control tube.

An inherent characteristic of any frequency or phase modulation system is the ability of the receiver to reduce noise in the presence of a received signal. Such noise reduction is a function of the limiter stages. The "limiter" can be likened to a sort of an electronic gate that regulates or limits the amplitude of signals passing through. This action eliminates any varying amplitudes. As a result, the discriminator receives a constant amplitude voltage from the limiter stages.

In the absence of a received signal, the limiter stage feeds a constant level of *noise* voltage to the discriminator which is reproduced at the speaker. The primary purpose of the squelch circuit is to shut-off or "squelch" this unwanted noise during periods of no signal reception. The squelch circuit amplifies and rectifies this nuisance noise and uses it to bias the first audio stage to cut-off, thereby silencing the speaker.

Squelch Action With No Signal

A simplified partial diagram of the squelch circuit is shown in Fig. #1. With no signal, noise is passed through the limiter to the discriminator and in turn to the control grid of the noise amplifier stage. A frequency selective network (C2,R3) attenuates voice frequencies in the range of up to 3000 cycles, but allows noise above these frequencies to pass through to the grid of the noise amplifier tube. In the cathode circuit of the noise amplifier is a variable potentiometer (R4) which controls the gain of the tube, thereby becoming a "squelch" control. The output of the noise amplifier drives the noise rectifier stage.

A positive rectified noise voltage from the noise rectifier appears across the load resistor (R5). A negative DC voltage is taken from the grid of the second limiter, through an isolating circuit (R1,C1,R2) and applied to the same load resistor. The *sum* of the negative limiter voltage and positive rectified noise voltage appears across the load resistor. The

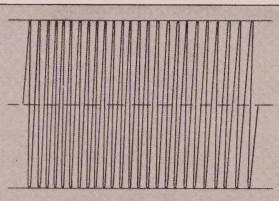


Figure #2a. Noise in the absence of signal

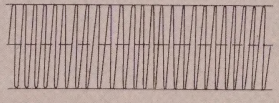


Figure #2b. Reduction in Noise from the presence of a carrier

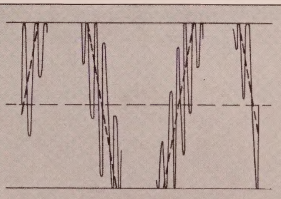


Figure #2c. Signal and Noise output waveform from the noise amplifier resulting from modulation of carrier

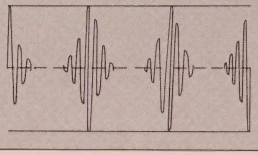


Figure #2d. Signal and Noise amplifier waveform with audio portion removed and applied to the rectifier in bursts.

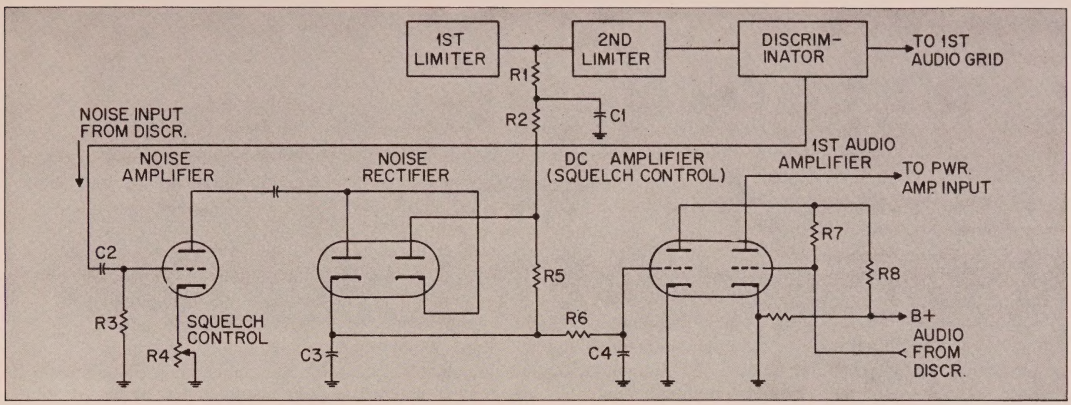


Figure 1. Expanded Simplified Partial Squelch Circuit.

resultant difference voltage (depending on which of the above two voltages dominate) then appears at the grid of the DC amplifier. A time delay network (C3,R6,C4) is provided to smooth out fluctuations and irregularities.

If the voltage at the grid of the DC amplifier is at zero or positive potential, the DC amplifier conducts and results in a voltage drop across plate resistor (R8), making the junction of resistor R7 less positive. This "negative going" voltage appears at the grid of the first audio stage through resistor R7, and biases the audio stage to cut-off. No amplification is possible in the audio stages and the speaker is effectively silenced.

Squelch Action With Signal

With a signal being received, the amplitude of the signal voltage over-rides the noise voltage, reducing or eliminating the noise. Consequently, the positive rectified noise voltage appearing at the load resistor (R5) decreases. The differential voltage at the grid of the DC amplifier becomes negative and biases the tube to cut-off. As a result, current ceases in the plate resistor (R8) and the voltage rises at R7 making the grid less negative with respect to the cathode. Squelch action will then be removed and the signal voltage appearing at the grid of the audio section of the squelch tube is amplified in a normal manner, amplified again in the final audio stage and fed to the speaker.

"Clamping" On Weak Signals

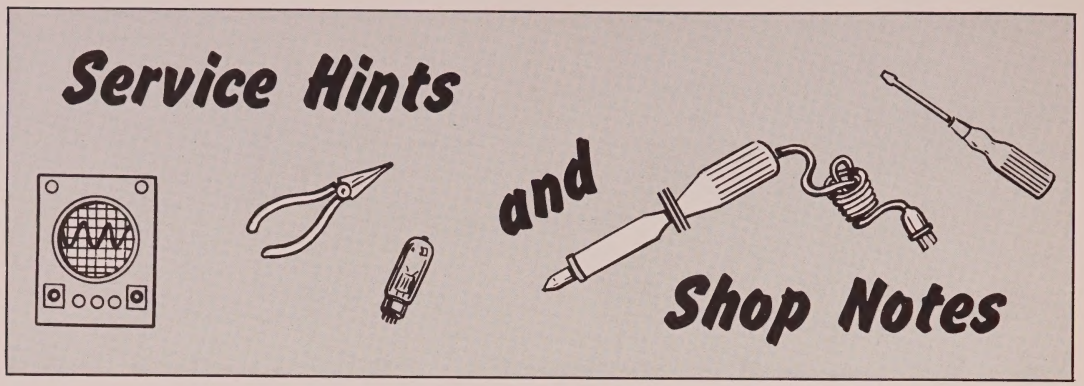
As previously stated, noise is reduced or eliminated in the presence of an RF carrier signal. A certain minimum carrier strength is needed to over-ride the inherent noise level and "open" the squelch. This point or condition is referred to as *threshold*. A weak unmodulated carrier just sufficient to open the squelch may not hold the squelch open when the carrier is modulated.

This action can be explained as follows: Modulation of a carrier results in the transmitted power being spread out or distributed into side bands above and below the carrier frequency. This transmission of power into side bands lowers the amplitude of the carrier, with a resultant increase in positive noise voltage appearing at the noise rectifier load resistor (R5). In addition, all modulation harmonics above 3000 cycles add further to the total positive noise voltage. When the differential voltage appearing at the grid of the DC amplifier becomes positive in nature, the first audio stage is biased to cut-off. The speaker is effectively silenced and the message is lost.

Motorola "Anti-Clamp" Design

In the exclusive Motorola "anti-clamp" squelch circuit, both noise and *audio* voltages are utilized in the control of the audio stages to prevent such "clamping" action.

The noise and audio voltages are taken from the discriminator output and applied to a *limiter type* noise amplifier. This type of noise amplifier is biased in such a manner that no limiting action will occur on noise input alone (Fig. ♯2a). In the presence of an unmodulated carrier signal, there is a reduction in noise as shown in Fig. ♯2b. However, when the audio voltages are present, they combine with the noise voltages for an increase in amplitude at the input of the noise amplifier. This increase in amplitude causes a limiting action in the output waveform as shown in Fig. ♯2c. An RC coupling to the noise rectifier removes the audio portion of the output as shown in Fig. ♯2d. The remaining peak noise amplitude of Fig. ♯2d appears greater from that of Fig. ♯2b (before modulation). However, the *average* value of noise is of *equal value or less.* Therefore, an increase in noise voltage resulting from a lowering of the carrier amplitude through modulation is offset by the limiting action of the noise amplifier-limiter. This action maintains the positive rectified voltage at a constant value and the squelch will not be affected by the modulation of the carrier. This "anti-clamp" design of the Motorola squelch circuit, prevents squelch blocking of a carrier when modulation is applied to the carrier. » » »



REMOTE SQUELCH CONTROL FOR "PRIVATE-LINE" BASE STATIONS

Remote disabling of receiver squelch in 25-54 and 144-174 mc remotely-controlled PRIVATE-LINE Base Stations for testing and "monitor-before-transmit" purposes can be accomplished by biasing the cathode of the squelch control tube to cut-off with the DC voltage across the coil of the base station transmit-receive relay (K1). This permits the receiver squelch to be disabled by depressing the MUTE RCVR NO. 2 button on the PA-8270 Remote Control Consolette, or by operating an added toggle switch on the FSC-Series Remote Control Console. This remote squelch control can be accomplished over either 2-wire or 4-wire 500/600 ohm control lines.

2-WIRE CONTROL LINE

Connections to the P-8066-N Remote Control Chassis (in base station) should be as follows:

1. the squelch lead (blue-with-brown-tracer), normally connected to terminal 6, middle row, must be connected to terminal 4, middle row, on the remote control chassis.

2. a jumper must be connected between terminals 1 and 3, middle row, on the remote control chassis.

The PA-8270 Series Remote Control Consolette does not require modification.

The P-9001 Conpression Amplifier in the FSC-Series Remote Control Console requires the following modifications:

REFER TO FIGURE #1.

Parts required:

(2) resistors, carbon, 1500 ohm, ½ watt, ±10% Motorola Part No. 6R6038.

(1) terminal strip, 2 lugs Motorola Part No. 31R490143.

(1) toggle switch, DPST, spr. return, nor. open contacts Motorola Part No. 41K811-760.

6′ #24 stranded cable lead Motorola Part No. 10M50.

Drill a 15/32″ diameter hole in the blank plate adjacent to the clock on the console panel and mount the DPST toggle switch. Mount the terminal strip on the blank plate's bottom mounting screw. Connect a 1500 ohm resistor between each of the terminal strip's lugs and the front lugs of the DPST toggle switch. Connect a cable lead:

a. from the left (facing the back of the unit) lug of the terminal strip to pin #1 of the (J3) rectangular Jones Plug.

b. from the right lug of the terminal strip to pin #2 of the (J3) rectangular plug.

c. from the left rear terminal lug of the DPST switch to terminal #14 of the existing E2 terminal strip.

d. from the right rear terminal lug of the DPST switch to terminal #19 of the existing E2 terminal strip.

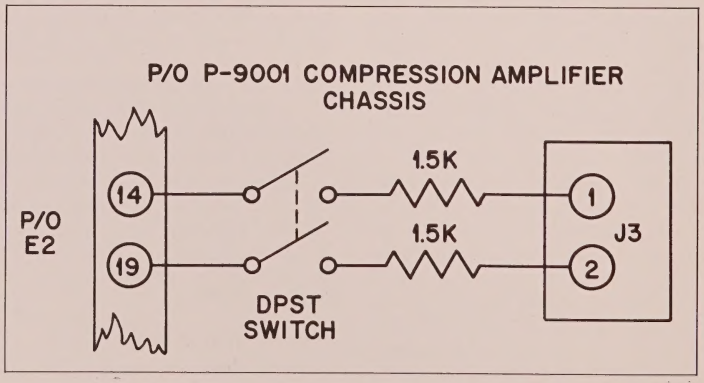


FIGURE 1. FSC-Series Remote Control Console modifications to enable remote squelch control of PRIVATE-LINE remotely-controlled base stations.

These modifications place a resistor in series with each lead of the 2-wire control lines (in series with each lead in the *DC pair* of a 4-wire control line) to develop the proper potential for biasing the squelch control tube to cut-off when the DPST switch is operated.

4-WIRE CONTROL LINE

Connections on the P-8066-N Remote Control Chassis (in base station) should be as follows:

1. the squelch control lead (blue-with-brown-tracer), normally connected to terminal 6, middle row, must be connected to terminal 2, bottom row, on the remote control chassis.

2. a jumper must be connected between terminal 1, middle row, and terminal 1, bottom row, on the remote control chassis.

The PA-8270 Series Remote Control Consolette does not require modification.

The FSC-Series Remote Control Console requires the modification described for operation with a 2-wire remote control line.

CAUTION!

The following factors are to be considered when making the connections between the base station and the remote control console or consolette:

1. **Control Line Polarity**—must be observed such that when MUTE RCVR NO. 2 button (or DPST switch) is depressed:

a. **for 2-wire control lines,** terminal 8, bottom row, will be positive and terminal 7, bottom row, will be negative.

b. **for 4-wire control lines,** terminal 2, bottom row, will be positive and terminal 1, bottom row, will be negative.

2. **Control Line Voltage**—must be maintained at a value that will allow cut-off of the squelch tube without operating the base station transmit-receive relay. Usually this value is at approximately the 20 VDC level at the remote control chassis. An operation check can be made by depressing the MUTE RCVR NO. 2 button (or DPST switch) while observing the action of the relay. If necessary, the correct DC level is obtained by adjusting the low voltage tap on the bleeder resistor in the console (or consolette) power supply.

3. **Hum Considerations**—prevention of audio hum pick-up requires first the *absence* of any *earth ground* connection at the console (or consolette). Any hum difficulties encountered are then due to inherent unbalance characteristics of the control line, or if the control line is unusually long. In such cases, connect a series combination of the following listed components across the control line input terminals at the console (or consolette), and rebalance the line with the LINE BALANCE control for minimum hum:

(1) resistor, carbon, 1000 ohm, ½ watt ±10% Motorola Part No. 6R6229.

(1) capacitor, metalized paper, 1 MFD Motorola Part No. 8K-833277. » » »

INCREASING 5763 TUBE FILAMENT LIFE

The 5763 tube, employed in Motorola 450-470 mc transmitters (Model Series TA147 and TU204) and 25-54 mc 100 watt "J" transmitter (Model Series TA200 and TA202), has a filament design center of 6.0 v compared to a nominal 6.3 v design for the other tubes in the above units. Motorola "TWIN-V" 6/12 volt power supplies have a self-adjusting voltage equalizer circuit which maintains approximately half-voltage on each filament string for 12 volt operation. Nevertheless, filament life expectancy of this tube may be shortened somewhat when continuously subjected to higher-than-normal vehicular battery voltages, frequently encountered in cars with 12 volt electrical systems when voltage regulators are not properly set. The possibility of this problem occurring can be easily eliminated by placing a voltage dropping resistor in series with one side of the tube's filament as follows:

450-470 MC XMTRS

Mount a terminal strip (Motorola Part No. 31R490141) adjacent to the 5763 tube socket using the same mounting bolt securing C42 (500 MMF, silver mica capacitor) in position on the chassis. Remove the green-with-yellow-tracer lead from pin #5 of the 5763 tube socket and re-connect to the terminal strip lug. Connect a 1.5 ohm, wirewound, 3 watt resistor (Motorola Part No. 17A851523) between the terminal strip lug and pin #5 of the 5763 tube socket.

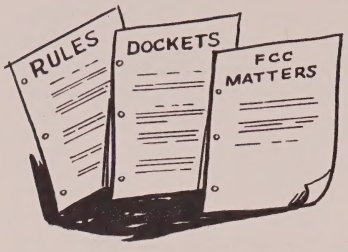
25-54 MC "J" XMTRS

Remove the short brown wire between pin #5 of the 6U8 tube socket and pin #4 of the 5763 tube socket and replace with a 1.5 ohm resistor as above. Use a 5/8" length of sleeving (Motorola Part No. 11M9530) on the resistor lead which connects to pin #4 of the 5763 tube socket and adjust so that the lead is insulated from the other pins of the tube socket. » » »

SERVICE MANUALS

As a continuing customer service, stocks of instruction manuals are maintained by Motorola to fulfill the needs of users and Motorola Service Stations in assuring proper equipment maintenance. Manuals for all Motorola equipment are available at nominal cost.

Requests for replacement service manuals may be placed with the Motorola Parts Department in Chicago or the Southern or West Coast Parts Depots. Such requests must include either the part number of the manual or the *full* and *exact* model number of the equipment to be serviced. Orders cannot be filled from incomplete information. » »



F. C. C. BULLETINS

Excerpts from publications of and about the Federal Communications Commission

PROPOSED SMALL FORFEITURES

Changes recommended in the Communications Act by the FCC would allow levying of small forfeitures for minor violations of the Commission's Rules, particularly for non-broadcasting services. The recommended changes are to be submitted to both Houses of Congress. A similar act proposing small fines changes died in the last Congressional session. » » »

YEAR-END STATISTICS

The following are some interesting statistics culled from the annual year-end statement by the chairman of the Federal Communications Commission:

Contrasted to less than 4,500 broadcast radio stations, not counting their auxiliaries, there are now nearly 360,000 other radio station authorizations . . . some of these non-broadcast authorizations cover literally hundreds of associated mobile and portable units . . . this being particularly true in the Public Safety, Industrial and Land Transportation Services which are authorized to employ over 386,000, 275,000 and 251,000 transmitters respectively . . . in other words, non-broadcast transmitters now outnumber broadcast transmitters nearly 200 to 1 . . . the number of commercial and amateur operator permits of different grades now exceeds 1.25 million.

Radio is being harnessed to industrial uses on a scale never before known . . . some examples of trade utilization of radio: 14,000 industrial stations with 116,000 transmitters . . . 17,000 power and petroleum stations with 143,000 transmitters . . . 1,400 forest products stations with 13,500 transmitters.

As far as land transportation is concerned . . . 5,000 taxicab stations represent the use of 103,000 transmitters . . . 1,800 railroad stations have 59,000 transmitters . . . 200 passenger bus systems operate 3,800 transmitters . . . 1,700 trucking stations require 25,500 transmitters.

In the public safety field . . . 11,000 police department stations with nearly 300,000 transmitters . . . 3,300 fire department stations with 39,000 transmitters . . . 2,800 forestry conservation stations with 23,500 transmitters . . . 1,900 highway maintenance stations with 17,000 transmitters . . . and, 2,400 special emergency stations with 9,000 transmitters.

NOTE: *The above figures represent the totals authorized, recognized as being a higher figure than the number actually in use.* » » »

FREQUENCY CHANGE REQUESTS

It is the customary practice of the Federal Communications Commission to issue a modified license when granting an application for change of frequency to a licensed system. The applicant's previous license is then considered to be cancelled, as the licensee may hold only one valid license for his station. Thus, upon receipt of his modified license, the licensee must change immediately to the new frequency which he has requested at the risk of operating illegally on the original frequency which he is no longer licensed to use.

The applicant may safeguard against this situation in the following manner: when applying for a change in frequency, he should send along with his frequency change request, a second application which requests authority to continue operation on the original frequency for a period of ninety days, if such time is considered necessary to make the transition.

MOTOR CARRIER RULES REVISED

In line with a November, 1956, request of the American Trucking Associations, the FCC finalized revisions in the low band (43-45 mc) Motor Carrier Radio Service to permit a carrier of property operating between urban areas to communicate not only with vehicles engaged in similar inter-urban operations, but also with vehicles engaged in local pickup and delivery operations.

The amended rules, effective as of January 22, 1957, permit a carrier of property who provides a transportation service between urban areas—and thus qualifies for frequencies in the 43-45 mc range—to use his radio system for communication with his vehicles engaged in the local pickup operation but only if the property being carried locally has been shipped, or is destined to be shipped, between urban areas. » » »

NEW PRODUCTS

Model TA203 "Quik-Call" Console, illustrated, measures only 13" x 10" x 7".

QUIK-CALL SELECTIVE SIGNALING BASE STATION EQUIPMENT

New QUIK-CALL base station console offers complete base-to-mobile selective calling facilities in a single, compact package.

Most recent addition to the Motorola "Quik-Call" selective signaling line is the Model TA203 Console which, for the first time, combines all tone sending elements — tone generator, power supply, timer, and code selector— in a single desk-top mounting console. Greatly simplified with respect to installation, adjustment and operation, the console may be added quickly and easily to any existing two-way radio system, regardless of make or model.

Also available for the first time is a companion TU369 Selector Box, which permits "one-touch" transmission of the standard four-tone coded signal. With this companion unit, the operator has only to press a single button to transmit the selecting signal. The console and selector box can be connected together for side-by-side operation or may be separated by as much as 100 feet.

"QUIK-CALL" SYSTEM

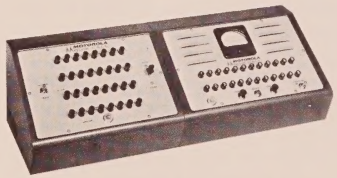
The exclusive Motorola QUIK-CALL system of selective signaling functions on the basis of audio tone pulses automatically superimposed on the radio carrier. A 2-pulse 4-tone system of encoding, employing the *Vibrasender* tone generator and *Vibrasponder* tone decoder, provides an exceptionally high degree of stability and reliability. The most common application of this equipment is to maintain silence at the receiver until signals from the base station are transmitted for that particular receiver. It is also possible, however, to control a variety of other functions. Alerting devices, such as bells, horns, sirens or lights, can be operated. Remote control of base and repeater stations and many other remote switching functions are possible. Any system capable of transmitting voice frequencies is normally capable of carrying tones to perform control operations.

BASE STATION CONSOLE

With the new integrated system, all encoding facilities are located in a single console unit. Installation consists simply of locating the console convenient to the operator, and connecting it to the transmitter for locally-controlled operation, or to the remote control console if the transmitter is located at a distance. Plugged into the nearest 117 VAC, 60 cycle outlet, the unit is immediately operative. Setting tone levels, formerly a complex process involving the use of auxiliary test equipment, is accomplished with the equipment contained in the console. A panel-mounted db meter together with a push-button operated test circuit, permits the operator to check tone amplitudes without leaving his position.

AUXILIARY SELECTOR BOX

Added convenience is afforded by the optional addition of a TU 369 Selector Box. This unit reduces the code selection procedure to a single function on the part of the operator. He merely selects one push-button and the four tones associated with the chosen code are then automatically transmitted. The selector box also offers maximum insurance against false selections—an important feature to fleet dispatchers and others having continuing selection operations. Up to ten boxes can be paralleled to provide as many as 320 pre-selected codes.



Arranged side-by-side, selector box and console measure only 25" long, overall.

MAINTENANCE OF

Microwave Communications Systems

THE KEY TO RELIABLE OPERATION OF A MICROWAVE SYSTEM IS DETAILED EXECUTION OF A STANDARD ROUTINE MAINTENANCE CHECK OF THE ENTIRE SYSTEM IN AN ORDERLY FASHION. ELECTRONIC EQUIPMENT OPERATING UNDER NORMAL CONDITIONS WILL USUALLY GIVE WARNING BEFORE FAILURE THUS ALLOWING MEASURES TO BE TAKEN TO PREVENT SUDDEN UNTIMELY OUTAGES.

A definite maintenance routine should be performed on the complete microwave station approximately once each month. This period may be lengthened or shortened depending upon operational experience and required degree of reliability. However, current FCC rulings require that frequency be checked, tuned, and logged once each month. Motorola microwave equipment provides a built-in frequency monitor cavity for this purpose. A station log sheet must be maintained for each station in accordance with applicable FCC regulations and to provide running indications of changes in meter readings which may indicate eventual trouble. The log sheet must be signed, dated, and the technician's FCC Operators License number, class, and expiration date shown.

The station log provides a permanent record of the overall operation of the equipment, giving the user facts with regard to performance of a particular station over a period of time. The routine procedure and log sheet include steps for checking the complete operation of all the electronic equipment, regulating transformers, and emergency power supplies. Component changes or adjustments required are recorded on the log for a permanent record.

A preliminary general inspection greatly aids overall observation of the condition of equipment. There are many troubles which can be easily seen that are not readily discernible by measurement and normal maintenance routine. Such things as an overheated and discolored resistor can often times be detected visually before it fails.

PROCEDURE NOTES

Standby equipment, if employed, should be energized immediately to allow warm up time while checking the main equipment. If it is apparent upon arrival at a microwave station that trouble exists, the trouble should be cleared before proceeding with any further maintenance. The normal procedure followed in running a routine station check involves first checking the AC supply voltage, then the power supply DC voltage output and ripple, and recording them on a log sheet. Power supply output voltages are checked using the metering facilities on the control panel. In the event that any voltage is off over 5%, the output should be adjusted to the correct voltage and the adjustment recorded on the station log. Repeated adjustments are indicative of impending trouble in the regulator circuit. The ripple voltages are checked using a high sensitivity AC vacuum tube voltmeter having adequate DC voltage rating on the input terminals.

The main equipment klystron beam currents are then checked, and the receiver and transmitter are tuned. If klystron beam current has dropped below the aver-

age of previously recorded values by a significant amount, the klystron should be changed, and the circuit retuned before taking meter readings for the station log.

Readings for the station log involve checking the receiver tuning, AFC circuitry, and IF strip limiter current. Care should be exercised each time meter readings are taken to make sure that all circuit conditions remain the same.

All elements of the subcarrier transmitter and receiver should also be checked regularly and the performance of each unit logged.

After the main equipment has been checked out, the procedure is repeated for the standby equipment. The sensing circuit operation is then tested to insure that the station will switch to standby with introduction of a fault. The final step is to return the station to normal operation and visually inspect all switches and controls to ascertain that all are left in the proper position.

VACUUM TUBES

Statistics have proven that vacuum tubes are the most prevalent cause of failures in electronic equipment. A good tube replacement program can do much toward obtaining maximum efficiency and reliability from a microwave system. Vacuum tubes that have been operating for a period of 500 hours or so are less likely to fail than tubes that have more recently been put in service. Many tube failures occur in the first 50 hours of operation. Usually the decline of emission is a gradual process throughout the normal, useful life of the tube. One purpose of routine maintenance is to periodically ascertain the condition of tubes and replace them as they finally reach the point of rapidly increasing degradation, before they fail and interrupt the entire system.

The routine use of tube checkers on a continual basis to measure tube performance in a circuit is not recommended as a normal practice in preventative maintenance of microwave systems. The disturbing effects of removing properly operating tubes from their sockets for the sole purpose of a measurement on a tube checker can subtract many hours of useful life. It will perhaps result in substituting a new tube, with a statistically higher failure rate, for a perfectly satisfactory "veteran" which has survived the first crucial 500 hours and is capable of yielding many more hours of satisfactory service. The "veteran" may not quite measure up to par with respect to the chart in the tube checker, but, in the face of no other evidence of malfunction, may perform quite satisfactorily in a particular circuit.

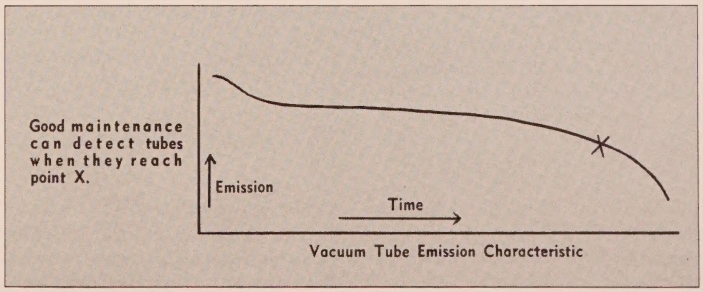
The first indication of possible tube trouble is sub-par performance of the equipment. If the trouble is not too apparent, then the tubes should be checked with a Gm type tube tester. *Each tube that passes the tube check must be returned to the socket from which it was taken.* Any that fail to meet minimum standards should be replaced with a new tube and the unit operation rechecked.

Reflex klystrons are checked by observing beam current meter readings with proper voltages applied and the circuit tuned up for proper operation. The power monitor meter reading can aid in determining a klystron's condition if certain factors are taken into consideration. The meter sensitivity control and the age and condition of the crystal diode affect the power monitor meter reading. Experience has shown that most klystrons should be replaced after approximately 25% decrease in beam current to prevent unannounced failure. Klystrons have shown average lives in excess of 20,000 hours; some in excess of 40,000 hours.

RELAYS

Relay contacts should be checked periodically and burnished when contacts are pitted. Stepper type relays should be lubricated periodically. Contact clearances, air-gap spacings, and spring tensions of relays should be checked from time to time to assure positive wiping action and contact separation.

A good technician will follow his maintenance procedure faithfully. Thoroughness in the performance of routine maintenance and diligence with regard to keeping the equipment in top operating condition will pay dividends in better system performance at less cost. Inadequate maintenance results in emergency action to clear up unanticipated problems which could have been avoided. » » »



Vacuum Tube Emission Characteristic

THE TRANSISTOR AS AN AUDIO FREQUENCY AMPLIFIER

by
HUGO KORN
Applied Research Department

The transistor, as a three terminal amplifying element, can be used in the form of three different circuit configurations; common base, common emitter, and common collector. The term "common" rather than "grounded" is used to indicate that the particular terminal is common to both the input and output stages. It may or may not be grounded depending upon the particular bias scheme used. Each of these circuit configurations has advantages and disadvantages with regard to audio frequency amplifiers. Figure 1 shows the schematic circuit representation of each configuration.

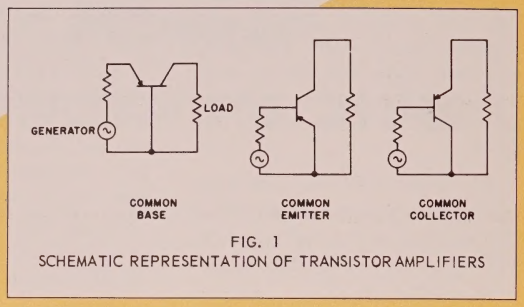


FIG. 1
SCHEMATIC REPRESENTATION OF TRANSISTOR AMPLIFIERS

Usually, the first consideration in the choice of a transistor for an audio amplifier is the amount of gain that can be obtained by the use of that particular unit. The only type of gain that has any significance in transistor technology is power gain, and the word gain will hereinafter be reserved to indicate such power gain. Any increase in current or voltage through the device will be referred to as amplification. In the case of vacuum tubes, at least for small signal amplifiers at audio frequencies, the input of the tube is considered an infinitely high impedance so that the input power delivered to the stage is zero. However, in the case of the transistor, the input impedance is a rather low value so that appreciable input power is consumed. Therefore, to be meaningful, we must consider power gain to get a true measure of performance of the device.

To make the necessity of considering power gain even more concrete, consider the case of a transformer with a low impedance primary and high impedance secondary winding. If the output and input voltages were measured and their ratio considered as a voltage amplification, the amplification could be said to be appreciable. However, if the ratio of output to input *power* were considered, attenuation rather than amplification would be observed since, like all physical passive systems, the transformer would have internal losses. This is the same in the case of the transistor, which usually has a low input impedance and high output impedance. If only the input and output voltages were measured, it would indicate that the device had an amplification that was far in excess of what the value of the power gain actually was.

The gain of a cascaded series of stages or the gain from a given transducer will be a maximum when the input of the following stage is matched to the output of the previous stage or source. However, just as in the case of vacuum tubes, it is still possible to have appreciable gain without having a completely matched condition. The input resistance of a transistor is determined by the output load resistance, and the nature of the variation of the input resistance with load is determined by the particular circuit configuration used. The output resistance of the transistor amplifier is a function of the source resistance also.

There are a number of different ways of specifying the power gain of a transistor, depending upon the ultimate usage of this information. For instance, we may determine a value of power gain for the transistor by measuring the power input without consideration for the value of source impedance and compare this value with the power output. This will be a measure of power gain of the unit but has somewhat limited usefulness. For example, if the application required amplification of the output of a dynamic microphone with a given load resistance the principal consideration would be to determine the best match to both the source and load as well as the highest "inherent" gain. If it were desired to compare the operation of two transistors for this application, it would be desirable to know their transducer gain, which compares the maxi-

mum power output of the source to the power output of the transistor. Under these conditions, the unit providing a higher value of transducer rather than inherent gain would be the better choice.

In specifying transducer gain, it is always necessary to indicate both the generator and load impedances while, in the first case mentioned above, it is only necessary to know the value of load impedance. It might be argued that the necessary information is required in both cases to obtain the data but a comparison of Figs. 2 and 3 will illustrate the point. Fig. 2 shows that both the common collector and the common base configurations have approximately the same gain at a load impedance of 2000 ohms and therefore might be considered as equally well suited for a given application. However, Fig. 3 which shows the transducer gain for a 50 ohm source, shows that the common base is a far better choice. If, on the other hand, the source impedance were 50,000 ohms, the common collector configuration would have a higher transducer gain. However, the common emitter configuration would have the greatest gain under both conditions even though mismatched.

The quantity that is most nearly analagous to the amplification factor "y" of a vacuum tube is the quantity "oc" or current amplification of the transistor. In general, the higher gain unit has a higher value of current amplification but, in the sense that the input and output resistances are also functions of alpha, (oc) it is possible that substitution of a higher oc unit may not result in superior performance in a given circuit because of mismatch losses. A high value of current amplification is particularly desirable in a directly coupled (no impedance transformation) cascaded amplifier since the power gain is approximately equal to the current amplification squared without regard for terminating impedance changes. However, in the case of transformer coupling, where an impedance match is desired to obtain maximum gain, substitution of a different transistor type than originally specified may not result in higher gain due to changes in other parameters than the current amplification. The following summary presents the essential features of each circuit configuration at audio frequencies.

COMMON BASE — Ideal for operating from a low source resistance to a high load resistance— current amplification always less than unity although voltage amplification is very large. The relative isolation between input and output is between that of the common emitter and common collector, but there is no phase reversal through the unit. The power gain for matched conditions is somewhat less than can be obtained from a common emitter stage on a matched basis.

COMMON EMITTER — Perhaps the most widely used of the three configurations, this will offer both current and voltage amplification with a phase reversal between input and output. The gain with the common emitter, under matched conditions, is the highest possible of any of the three configurations. The input and output impedances are rather sensitive functions of the short circuit current amplification, but there is the greatest isolation between these impedances of any of the connections. Although the common emitter offers the greatest power gain, the amount of distortion, for a given magnitude of output signal, will be greatest for this connection.

COMMON COLLECTOR — This connection offers the least distortion but also the least gain due to the high value of internal feedback. The common collector is most often employed as an impedance transforming device. The relative isolation between input and output is the least for this connection and there is no phase reversal. The voltage amplification is always less than unity although the current amplification is slightly higher than the common emitter. » » »

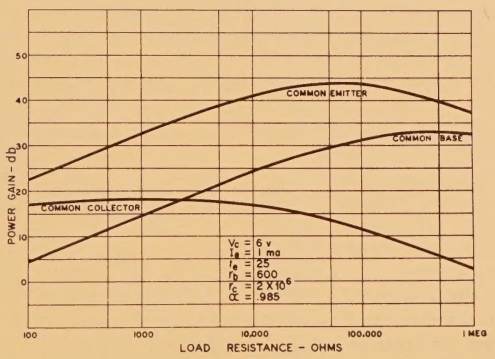


FIG. 2
POWER GAIN vs LOAD RESISTANCE
TYPICAL AUDIO TRANSISTOR

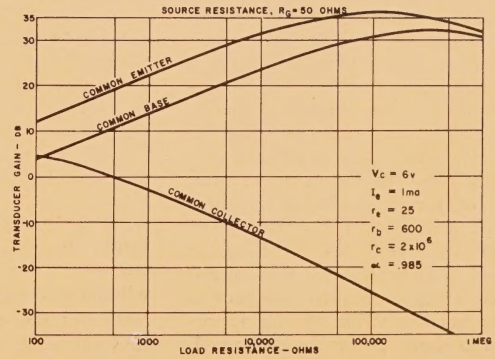


FIG. 3
TRANSDUCER GAIN VS LOAD RESISTANCE
SOURCE RESISTANCE, R_G=50 OHMS

NAME BYRNE MICROWAVE SALES MANAGER

W. C. Byrne, Jr.

Leonard G. Walker, Marketing Manager, Motorola Microwave and Industrial Control Department, has announced the promotion of Walter C. Byrne, Jr. to the position of Sales Manager for these products. Byrne will be responsible for the nationwide direct sale of Motorola Microwave, Power Line Carrier, Audio Multiplexing, Power Transmission Line Carrier Couplers, and Industrial Control Equipment.

Prior to his new assignment Byrne was Midwestern District Sales Manager.

With Motorola since 1950, Byrne was first a senior engineer and then a specialist in Microwave and Industrial Control Products. He holds both electrical and mechanical engineering degrees from Tulane University.

During World War II Byrne was a Naval officer assigned to destroyer duty. An active radio amateur, he constructed and demonstrated the first amateur television camera, transmitter and receiver in the South.

Byrne is a member of the Institute of Radio Engineers, American Institute of Electrical Engineers, and the Louisiana Engineering Society. » » »

JATIS MADE MANAGER OF 2-WAY RADIO SERVICE TRAINING

J. P. Jatis

Promotion of Joseph P. Jatis to Manager of Two-way Radio Service Training has been announced by John Tansey, National Service Manager of Motorola's Communications and Industrial Electronics Division.

In his new position Jatis is responsible for all of the service clinics held throughout the U. S. each year as well as the service classes held at Motorola's factory in Chicago. This educational program is designed to bring the latest maintenance techniques to Motorola Service Stations and Motorola two-way radio user technicians. A service offered by Motorola since the early days of two-way radio, it has met with enthusiastic response and has been expanded with the rapid growth of two-way radio in the industrial, transportation and public safety services.

Jatis has had extensive experience in both the manufacturing and servicing ends of electronics. He has been with Motorola since 1935 and prior to his promotion he was Assistant to the National Service Manager. » » »

STOTT NAMED REGIONAL SALES MANAGER

Russell L. Stott

Russell L. Stott has been appointed Regional Sales Manager for Motorola Communications and Electronics, Inc. His territory covers all of New York State except the New York City Metropolitan and Long Island areas.

In his new capacity, Stott will be responsible for the sale of two-way radio and other electronic communications and control systems throughout the area. His headquarters are at 118 Tracy Street, Syracuse, New York. His appointment, announced by Lowell E. White, Vice-President and Eastern Area Manager, became effective January 1.

Stott joined Motorola as a Radio Communications Engineer in 1951. He became a specialist selling radio communications systems to Trucking Companies in New England in 1955 and was promoted to Zone Manager of Western New York State in 1956. He earned his B. S. and M. S. degrees in Electrical Engineering at Massachusetts Institute of Technology. During World War II he served with the Navy as a radio technician. » » »

NEW PARTS CATALOG

The Spring 1957 issue of Motorola's Parts Catalog will be distributed in the early part of April. Included will be new sections on test equipment and accessories as well as a complete line of two-way radio parts. »

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TWX: SU 249

* * * *

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WHITNEY 5-7500
TWX Morsemere, N. J. 326

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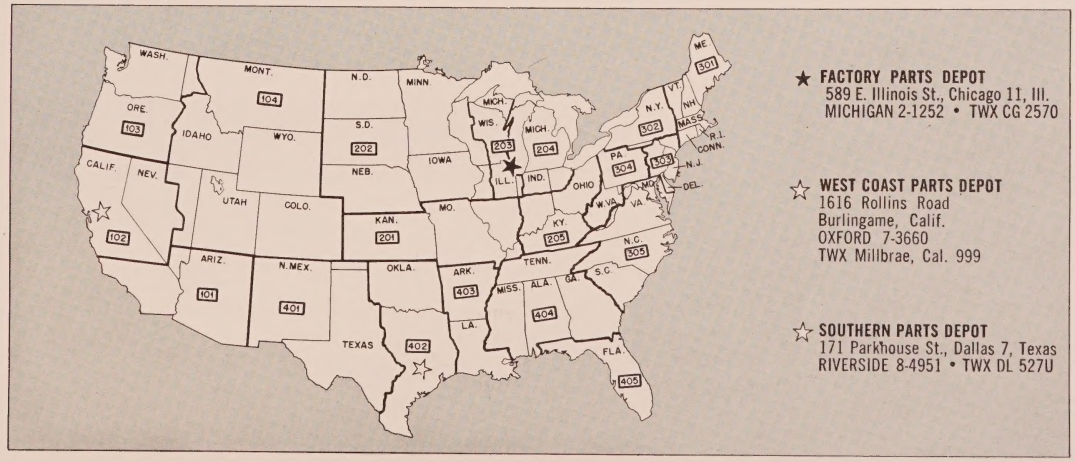

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